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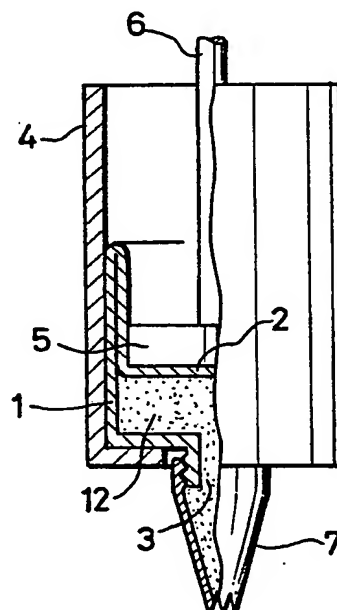
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(54) An extruding method of an extrudable substance, a container and a device, used for the method.

(57) The invention relates to a method, a container and a device for extruding an extrudable viscous, pasty and greasy substance, without replacing to other containers, using the cartridge type container at a final usage, without troublesome work of washing and cleaning after use, extruding required volume preset continuously and intermittently, without quality change and contamination, with least substance loss.

An extrudable substance in the invention includes such substances as custard or whipped cream, liver or meat paste, glue, grease, packing compound, and other greasy chemicals, food stuffs, etc.

## FIG.2



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# An Extruding Method of an Extrudable Substance, a Container and a Device, used for the Method

## Background of the Invention

(Industrial Field)

The invention relates to an extruding method of an extrudable substance, a container and a device which are both used for the method.

An extrudable substance, such creamy substance, as custard cream, chocolate cream, whipped cream, butter cream, such paste substance as peanuts paste chocolate paste, such food stuffs as mayonnaise, ketchup, and mustard, and such not edible substance, as packing compound for buildings, and various kinds of grease, do not easily flow out from an opening of a bottle when it is filled wherein and kept up side down with the opening downwards, but show fluid behavior, being extruded out from the opening by some outer force added. Hereafter such substance is called as said substance.

In case said substance is not for a final usage, but used as one of materials to make a final product, it is generally packed in an industrial mass produced container (for example, bag etc.) for delivery to final place of usage, and if a type of packing is not proper for the usage, other method must be necessary in a final step of usage, such as replacing to the other packings, or divided into some smaller containers.

For example, in such conventional case as custard cream or whipped cream is injected into a puff paste (choux a la creme), from several kilograms' can or plastic film type packing of above cream,

a) some required volume of the cream is replaced into a hand depositing sack and injected into a puff paste one by one by hand operations.

Or, without using a sack, said substance

b) is filled up directly into the object, by using a measuring spoon in final usage step, or in some case,

c) is automatically filled up into the object by automatic depositing machines, after replacing it into a hopper or a vessel of the machine.

But, in those conventional methods of discharging said substance to objects, there were following problems:

1. As a packing used for delivery (hereafter called as delivery packing) must be opened in usage, said substance is exposed in open air, and easily contaminated, surface dried, and oxidized, lacking desirable airtightness.

2. In case of usage, troublesome works and

time are needed for replacing said substance to other containers, and said substance is easily suffered from contamination from sanitary point of view and easily bring quality changes by touching open air, and some volume of remaining behind in delivery packing after use is inevitable, thus causing loss in production.

3. As a portion of said substance remained after use, which generally fed back to delivery packing easily cause quality change or sanitary contamination on a scale of delivery packing unit.

4. In case of replacing, and in a delivery packing itself, said substance sometimes may cause structural destructions and quality changes.

5. In case of hand discharging, error in volume discharged to object of products may take place, and an operator may feel fatigue, and discharging said substance, in case of high viscosity, needs much manual power, which may cause fatigue of an operator.

## Summary of the Invention

This invention was made in view of the problems involved in conventional techniques, and presents a new extruding method, by which said substance in a container can be extruded to objects, without causing quality changes, with least error in extruded volume, free from contamination and also sanitarily.

The invention, by fitting a container, which is filled with said substance in the holder, and pushing the container by a piston head from one side of said holder, and extruding required volume of said substance from an opening at the opposite side of the container, makes possible to extrude required said substance sanitarily and easily.

Namely, the container which is filled with said substance in its original shape, without replacing said substance to other containers, is filled in the holder of the specially arranged extruding device, and is pushed by the piston head from one side of the holder, and extrude required volume of said substance from the opening of the opposite side of the container to extrude said substance to objects, and after extruding required volume from said container, said container is taken off from the holder and is kept in stock in several hours waiting for next necessary fitting for extruding, or also after said substance is all extruded out from the container, which can easily be changed by another filled container.

Extruding in the invention, includes filling by injecting, dropping or topping on objects, filling up

in gaps or clearances of objects, and straight on a plane, and the container can be used for extruding said substance in required optional way.

In the invention, a device which is used for extruding said substance is described as extruding device, which is consisted of means of fitting and holding of the container, and means of extruding said substance in the container.

The container, referring to the invention, is that which can be used as a container for delivery as it is, and can be taken off from the holder, after said substance in the container is all extruded out, following a new next container fitting easily as above mentioned, is a changeable cartridge type (hereafter described as the cartridge).

The cartridge has one opening to extrude said substance outwards, which can be equipped with a nozzle if necessary, by which said substance can be extruded in required shape.

There are roughly two patterns of pushing the cartridge by a piston. One is, a pattern of pushing and compressing the cartridge from one side thereof as it is, when the inner diameter of the holder is nearly the same as the outer diameter of the piston head, in another word, there is no clearance between the holder bore and the piston head, and another is, when the outer diameter of the piston head is smaller than the inner diameter of the holder, and the clearance between the holder and the piston head is larger than twice as much as the thickness of the side wall of the cartridge, a pattern of pushing the cartridge by the piston head in a way that the side wall of the cartridge is drawn inwards and folded-in-doubles almost without sliding shift between the cartridge wall and the holder bore surface. In the invention, fitting the cartridge in the holder means fixing the cartridge mechanically, with its opening protruded outwards at one side of the holder, and with its side wall touching at the holder bore surface with almost no clearance in measure.

To extrude required volume of the substance from the opening of the cartridge, only the stroke length of the piston head must be adjusted accordingly for requirement, which is simply adjusted by using one-way inching mechanism, such as ratchet mechanism, by which extruding required volume of said substance one shot after another is easily be done, because the motion of the piston head becomes intermittent.

In such way of pushing the cartridge as that the side wall of the cartridge is drawn inwards and folded in double, the adjustment of extruded amount is easy, because the stroke length of the piston head is lineary proportional to amount of extruded volume until the substance in the cartridge gets almost empty.

#### Brief Explanation of the Drawings

Fig.~Fig.6 are all schematically illustrated to help explaining the invention, and

Fig.1 is for explaining the method of the invention in a phase, where the cartridge with a nozzle is in contact with the piston head,

Fig.2 is for explaining also the method of the invention in a phase, where the substance in the cartridge is extruded by the piston head pushing,

Fig.3 is for showing the shape of the bottom of the cartridge, which relates to the invention,

Fig.4 is for showing the shape of the bottom of the cartridge, which relates to the invention,

Fig.5 is for showing the side view of the composition of the extruding device, which can be used to embody the method of the invention.

The names of the parts are as follows:

1. cartridge body
2. bottom
3. opening
4. holder
5. piston head
6. piston rod
7. nozzle
8. piston head edge contact part
9. bottom plane edge
10. clearance
11. positioning groove
12. extrudable substance
20. holder for cartridge
21. clamp bolt
22. piston head
23. piston rod
24. rack
25. hand wheel
26. volume adjusting wheel
27. volume gauge
28. extruding lever
29. ratchet
30. ratchet wheel
31. table
32. main column

#### Detailed Description of the Invention

From now, the method of the invention is explained referring to drawing, if necessary.

Said substance, relating to the invention is extrudable substance, which shows somewhat self retaining character under no outer force influence, but shows fluid behavior under outer force influence. For example, such creamy and pasty substance as custard cream, chocolate cream, peanuts paste, peanuts butter, whipped cream, butter cream, cream cheese, etc., and such sweetened substance, as sweetened bean paste and jam, and

such seasoning substance, as mayonnaise, ketchup, and mustard, and also such batter substance as bread dough, cake batter, and cookie dough, etc., are extrudable and don't flow out easily from an opening, if no outer force is added.

Bread, cakes, and cookies are generally produced in production lines, but dough and batter can be delivered themselves, and the process of baking them can be separated independently from their production line, and in this case, batter can be extruded into object before final treatment or can be extruded and deposited direct on pans for baking.

Other than said substance which belongs to food industry, tooth paste, shoe polishing cream, grease, etc. are all included in said substance which relates to the invention. Such substances, which show extrudability are also included to said substance, as paste which contains fat of high melting point, which is solid at room temperature but becomes fluid and extrudable and as ice cream, sherbet, and whipped fresh cream, which are like liquid, but become pasty by chilling or freezing, changing to extrudable.

As in the invention, said substance in the cartridge needs not to be replaced to another packing in usage, and as said substance is extruded from the cartridge only by simple pressing, this method is applicable to extrude viscous substance or viscoplastic substance of thixotropy, which are easily damaged in their structure by outer force influence. For example, substance having gel structure which belongs to vegetable gelatin jelly, and having gel structure derives from protein degeneration, or ketchup and etc are applicable.

The cartridge which is used in the invention can contain said substance keeping its quality during delivery in markets, and has enough strength and flexibility to bear extruding said substance, without breaking under pushing pressure by the piston head in the holder, and also has quality keeping function.

Fig.1, Fig.2 shows schematically one example of extruding device with the cartridge which relates to the invention, and how the side wall of the cartridge is drawn inwards and folded-in-doubles. The outer diameter of the holder, and the cartridge is filled in the holder almost without clearance, and is pushed by the piston head at bottom 2 of the cartridge, caving in the cartridge itself. Cartridge is not necessary to equip with nozzle 7 in delivery stage, which can be put on the opening 3 when in use. And, before use, cartridge itself is a closed container with the opening 3 sealed, and for this reason, said substance is quality proved.

Fig.2 shows the cartridge, after most of the substance is extruded out, with only very little of the substance left behind, along the body wall

surface and etc of the cartridge, in another word, with very little loss, because the body wall surface of the cartridge is drawn inwards and folded-in-doubles without sliding shift in the holder 4 bore surface. And as the behavior of caving-in of the cartridge by the piston head pushing is stable, the piston head stroke length is well proportional to the extruded volume of the substance from the cartridge. And also the said substance stay unchanged in quality, without suffering from undesirable inner shift in the cartridge.

In above mentioned composition, the clearance between the outer diameter of the piston head and the inner diameter of the holder should be minimum two times as much the thickness of the wall surface of the cartridge, but should not be too large. From above reason, the clearance should be determined by the characteristics of the substance, pushing speed of the piston head, and shape and material of the cartridge. When the clearance is too large, the substance in the cartridge flow backwards positively in the reverse direction against the opening of the cartridge through the clearance, and when the clearance is too small, the side wall of the cartridge body is shrunk wrinkle-wisely by pushing of the piston head. For preventing such backward flow, the thickness of the piston head better be thicker. Especially, as there is a tendency of such backward flow takes place, when the viscosity of said substance is high and the opening of the cartridge is narrow, the clearance had better be set almost two times thickness of the piston head had better be set thicker.

The shape of the cartridge is preferably cylindrical post or ellipsoid like cross sectioned post with edgeless curved plane. And nozzles attachable to the opening 5 are of various kind of star patterns, and of other optional patterns.

From above mentioned extruding composition, said substance stay stable and not stale, because said substance is not exposed to open air, except the opening part, and suffer from least shift and agitation. And in case of stopping extruding on half way, the cartridge is easily taken off from the holder, after putting a cap or seal on the opening, and can be kept in stock, without contamination by the open air, caused by sucking it into the cartridge from the opening, proving its sanitary and contamination-free characteristic. And the amount of remain of said substance is easily seen, because the cartridge itself is somewhat perspective, and this is convenient for operators. Furthermore, keeping the clearance 10 always constant is possible by means of one or more positioning groove 11 in the bottom of the cartridge, shown in Fig.4, which is filled by a projection on the piston head, making surer connection of the bottom of the cartridge and the piston head in proper positioning.

As for raw materials of cartridge, following are available: Polypropylene, polyethylene, vinyl chloride, polycarbonate, Nylon, polyvinyle alcohol, polyester, etc., which are used for packing materials, and also laminated film of several kinds, and metal can, and also paper and metal foil can be used together with.

Thickness of the cartridge at the opening part is preferably thicker relatively than other parts, and the part of the cartridge should have enough strength to resist capping force. When the side wall of the cartridge is too thick, resistant force caused by drawing-inwards and folding-in-double of the side wall of the cartridge increases required pushing force of the piston head, giving the cartridge an excess force, resulting in occasional cracks in the cartridge undesirably. When the side wall of the cartridge is too thin, there may take place, explosion of the cartridge by less wall strength against inner pressure, and lack of extrudability of the cartridge, owing to the backward flow of said substance toward the back side of the piston head, which is not desirable, and also shortness of physical packing function of keeping quality, etc., in delivery stage. And the thickness of the side wall of the cartridge is determined according to the characteristics of said substance, to make drawing-inwards and folding-in-doubles of the side wall of the cartridge possible, when the piston head pushes the bottom of the cartridge.

On the other hand, there takes place high stress at near peripheral edge of the cartridge bottom where the piston head outer contact edge corresponds and there causes much tensile strain. By this reason, as shown in Fig.4, as the thickness of the cartridge at edge 8 had better be thicker than at other part of the side wall, and especially thicker thickness at edge 8 is more effective, in case that a larger pushing force is needed for said substance of higher viscosity and larger specific gravity.

And for reducing stress generated at the near part of the piston head edge, making a small round corner at the edge of the piston head, or making the piston head not flat, but in round shape, or making the bottom of the head holder and also near the opening part of the cartridge in corn shape, is effective. In this way, it becomes possible, that the volume of remaining said substance can be reduced, the pushing force of the piston head can be reduced, and extruding of said substance becomes smooth. Especially, shown in Fig.6, making the bottom of the cartridge and the part near the opening of the cartridge in corn shape, fitted closely in each other, and making the piston head and the bottom of the holder in same corn shape, make positioning of the piston head and the cartridge, and drawing inwards and folding-

in-doubles of the cartridge side wall easy, and reduce pushing force of the piston head, and the remaining volume of said substance in the side wall of the cartridge and near the opening of the cartridge is lessened, and above features are desirable. Ball shape is also available instead of corn shape. Not only at the bottom of the cartridge, but also at the near part of the opening, touching at the inner holding face of the holder, a considerable large stress are generated, so the thickness at this part, had better be relatively thicker.

And edge part of the bottom plane (bottom plane edge) is drawn and folded by pushing force, and when the thickness of this part is too thick, two times thickness of the side wall of the cartridge is not enough for the clearance between the piston head and the holder, and the clearance had better be larger. Thus, the clearance is to be determined properly considering the thickness of bottom plane edge and the thickness of the side wall of the cartridge. Bottom plane edge 9, and the part 8, where the piston head contacts easily generate stress, and when the bottom plane edge is too thick, the side wall of the cartridge can't easily be drawn-inwards and folded-in-doubles, so the thickness of the bottom plane edge 9 had better be determined not too thick, (the part 8, where the edge of the piston head contacts is left thick), and the shape of the part of the bottom plane edge of the cartridge is made in round at its corner without sharp line edge, or the bottom plane is made in round shape as a whole, to reduce the elongation by pushing force by the piston head at the surrounding edge part area. As shown in Fig.4, the bottom plane can be made just a bit caved-in to enable the piston head easily pushes the bottom plane, guiding the side wall of the cartridge drawn-inwards and folded-in-doubles for extruding said substances.

In above described composition of the pushing, in order to give the cartridge better characteristics for requirement in strength, flexibility, mouldability, etc., some improving additives of softener plasticizer, etc., may be added to raw resin material.

Referring to the moulding at the cartridge, blow moulding is preferable, by which, thickness around the opening and the bottom of the cartridge tends to be thicker than the side wall of the cartridge, and there exists no seam, and a proper moulded container as the cartridge can be obtained by the moulding. And such another cartridge of bag type container as using laminated film or a like is available, which has a reinforcing ring at the opening part, and keeps its body in a shape of a post with curved side wall, when filled with said substance. In this case, around the part of the bottom plane or near the opening, where stress is easily concentrated by pushing force, strength must be in-

creased by binding some reinforce with adhesives.

In any case, raw materials and shapes should be determined by the factors of the kinds of said substance, its volume, and also the size of the opening of the cartridge, etc. And, the chemical and physical properties, which relate both to the cartridge and said substance, such as oil proof, water proof, gass barrier, etc., must be considered. Thus, in short, the specification of the cartridge should be properly determined generally by the factors of both quality proof of said substance and the extruding function of the cartridge.

Next, following is the explanation of the extruding device to embody the method of the invention:

Fig.5 shows an example of the extruding device, consisted of a holder of holding the cartridge, a piston rod 23, a piston head 22, a ratchet part, which drive the piston rod 23 (a ratchet 29, a ratchet wheel 30, an extruding lever 28) and a volume adjusting wheel 26. The piston rod 23 has a rack 24, which is connected to a pinion, not included in the drawing, which is connected to the ratchet wheel 30, and the revolution movement thereof drives the piston rod 23 up and down, through the rack 24.

The ratchet wheel 30 is intermittently rotated by to-and-fro motion of the ratchet 29, which starts driving by operating the extruding lever 28, and the stroke is set by fixing the volume adjusting wheel 26, and the volume of said substance from the cartridge can be adjustable.

And when the cartridge becomes empty at the lowest position of the piston rod 23, it can be lifted up by means of a hand wheel 25 to the initial position. After above steps, the cartridge is set in a holder 20 for holding the cartridge, and an object to which said substance is extruded, is put on a table 31, and a required volume is set by the volume adjusting wheel 23, and the extruding lever 28 is moved downwards to extrude said substance into the object or between the gap of the object.

The holder 20 has a half, freely openable by hinges, which can be fixed by clamp bolts 21. And the holder has a hole at its bottom part, through which only the opening of the cartridge is protruded.

The outer diameter of a piston head 22 is smaller than the inner diameter of the holder, and the piston head has proper clearance enough to make the side wall of the cartridge drawn-inwards and folded-in-doubles, being pushed at the bottom of the cartridge. On the other hand, when the outer diameter of the piston head 22 is made smaller, and a disk of proper outer diameter is placed between the piston head 22 and the bottom of the cartridge, it is possible to embody the invention. In this case, the pushing area at the bottom of the

cartridge is adjusted only by changing the disk, according to the inner diameter of the cartridge. The pushing force of the piston head can be adjusted by changing the ratchet wheel diameter, the pinion pitch circle diameter, and the length of extruding lever, etc., according to the physical property of the cartridge and said substance.

And in another composition to embody the invention, the extruding lever 28 can be driven by electric power, and the holder 20 can be rotated around the center of a main column 32 to make plural cartridges available in one extruding device. And the motion of the piston head can be horizontal, called as a horizontal type, or slant at certain angle from horizontal line, called as a slant type, and the holder can be made by perspective hard plastics, to make possible operators to confirm remained volume of said substance by sight. And the holder can also be equipped with a jacket to make heat and cool the cartridge therewith.

And the ratchet mechanism can be replaced by a combination of worm and rack to make the same function of one way inching motion.

And, filling said substance in the cartridge can be made by an automatic filling machine by such a conventional way as in a bacteria free cleaned room. In case, oil proof, water proof and gas barrier materials are used for the cartridge, considerable long life of said substance is stock is possible in cartridge form, depending upon packing conditions of said substance.

### Examples

#### Example 1

In the cartridge of the shape shown in Fig.1 made of polyethylene by blow method, was filled with said substance of custard cream by a filling machine in an aseptic room and capped by heat sealing.

In this case, the cartridge was moulded with its bottom made slightly thick, and the opening with thread. The cartridge was 8 mm in diameter, 20 cm in height, and 1 l in volume, and the filled custard cream was 20 °C temperature, and 5500 cp in viscosity.

Nextly, the cartridge is set in the extruding device of the composition shown in Fig.5. At the beginning, the cap on the opening was taken off, a star type nozzle was fixed thereto, and then the cartridge was set in the holder 20, and the piston head 22 moves until it touches the cartridge by the hand wheel 25 and the extruding lever 28 until said substance comes just at the end of the opening (condition of no head space) and required

volume was set at 50 ml of volume gauge 27 by the volume adjusting wheel 26. On the table 31, a puff paste crust was placed, partially opened, and 50ml of custard cream was extruded thereto in ripple shape, by one full down stroke of the extruding lever. By repeating this operation, custard cream was extruded to nineteen puff paste crusts in total. And, after having lifted back the piston head 22 to the initial position by the hand wheel 25, the empty cartridge was taken off from the holder, and another next cartridge was set as the same way as above mentioned.

The cartridge which was taken off, was with the side wall thereof folded-in-doubles and successively caved inwards. And, in the cartridge, there could be seen almost no residual, proving the method wasteless.

After weighing the finished puff pastes, already filled by custard cream, no considerable error in total weight among each couldn't be found, with weight thereof around 60 g ( next weight of each puff paste crust was 10 g).

For reference, the outer diameter of the piston head was 78 mm, the height thereof was 30 mm, the inner diameter of the holder was 83 mm, the clearance between the piston head and the holder was 4 mm, and the pushing force of the piston head was 0,5 dyn/cm<sup>2</sup>.

#### Example 2

The same shape cartridge as Fig.1 was filled with said substance of harder batter, whose viscosity was 5200 cp and was set in the same extruding device as Exp.1, only with different outer diameter of 77 mm.

Pieces of dough moulded as shape of a buns on a pan was placed on the table, and after dropping batter of 25 ml with each stroke of the piston head on each dough piece by extruding, were brought into a final proof box, and baked, then the produced buns were of no error in weight. Thirty nine buns were baked from one cartridge, and there were least loss observed. The empty cartridge had its side wall folded-in-doubles and successively caved inwards, and was with no considerable residual.

#### Example 3

The same cartridge as Exp.1 was set in the perspective cylindrical cartridge holder (with inner diameter of 81 mm, thickness of 8 mm and length of 210 mm), and was pushed at the bottom of the cartridge by the piston (with outer diameter of 78 mm, made of perspective acrylic resin) manually

extruding required volume of custard cream into the puff paste, and a scale was attached to the perspective cylinder to make an operator read how much volume of the cream was extruded by sight. And changing of the cartridge was very easy.

#### Characterisitic of the Invention

As above mentioned, said substance is filled in the cartridge type container of easy changeable and is pushed at one end thereof to extrude said substance from another end, then said substance can be delivered and stocked in container form as it is, and extruding operation is easily done by the simple extruding device accordingly, the method of the invention is very useful method not only for whole salers, but also retail shops and house consumers.

Furthermore, following characteristics can be listed up:

1, As the extrudable substance exposes itself to the air, very little except the opening part for extruding, said substance suffers from least quality changes, that leads to superiority in constant quality keeping function.

2, As replacing of said substance is not necessary and other excess force doesn't take place except the force necessary to push the cartridge, the property change and pollution, etc. of said substance which easily suffer changes and destruction of structure, can be avoided.

3, Extruding operation of said substance is easy, saving troublesome work and labour.

4, In case when a portion of said substance remains in the cartridge, said substance can be stocked by only capping or simple sealing, and even before capping, the air can hardly get into the cartridge, avoiding staling of quality.

5, The extruded volume can easily be adjusted and error and loss are least.

6, Attaching required nozzle of various kinds to the opening before extruding operation is easy.

7, Equipping with the cartridge of plural number in the extruding device, makes optional selection of said substances for use, available.

8, Use of the cartridge for a container, keeps the extrude device, etc., free from contamination, eliminating troublesome cleaning, washing, and changing thereof.

9, Remaining volume of said substance in the cartridge can be checked by sight.

#### Claims

1. An extruding method of an extrudable substance comprising setting a container filled with an

extrudable substance in a holder and pushing a container at one side thereof, and extruding an extrudable substance of a required volume from the opening at the opposite side thereof.

2. The method of claim 1, wherein extrudable substance is extruded in a way that the side wall of the container is drawn inwards and folded-in-doubles when the container is pushed.

3. A container of extrudable substance, with a shape suitable to fit for a holder of an extruding device able to keep the contents therein stable, when it is left free, having enough flexibility to be deformed at its side wall, while extruding the substance from its opening by pushing force at its bottom.

4. An extruding device for extruding an extrudable substance comprising a holder, which holds a container of cylinder like body with its bottom face open, a piston head which can push the container at its bottom face, and at least a device of one-way inching motion to drive the piston head.

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FIG. 1

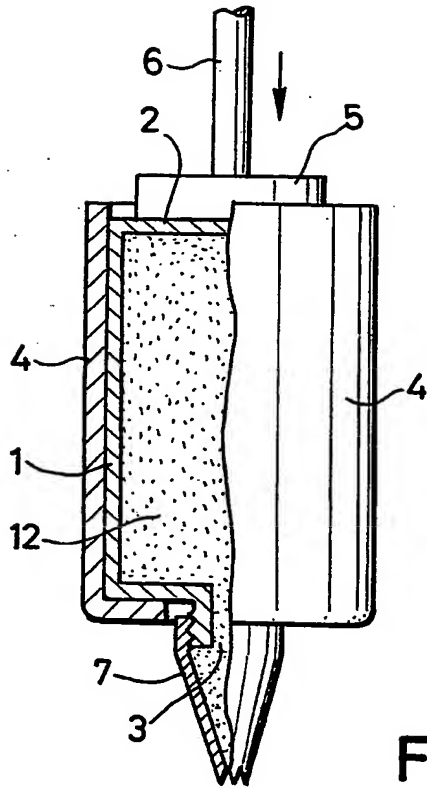


FIG. 2

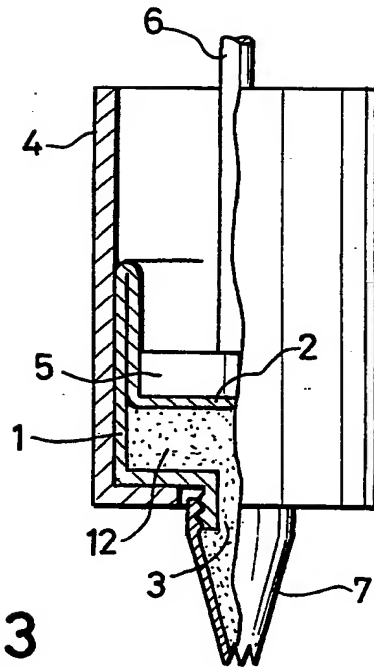


FIG. 3

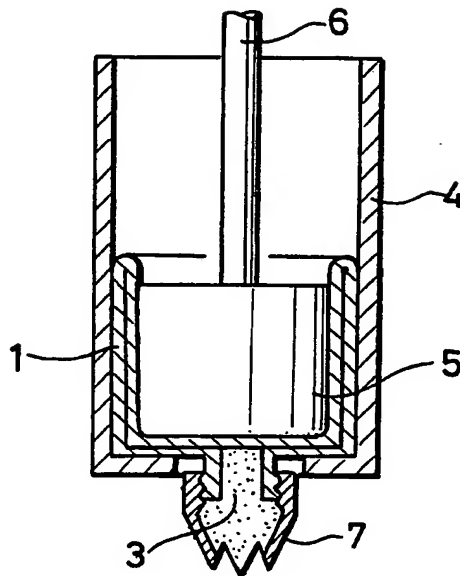


FIG. 4

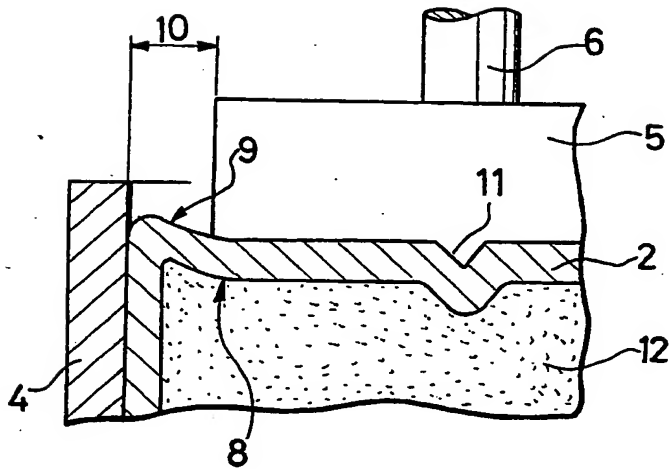


FIG. 5

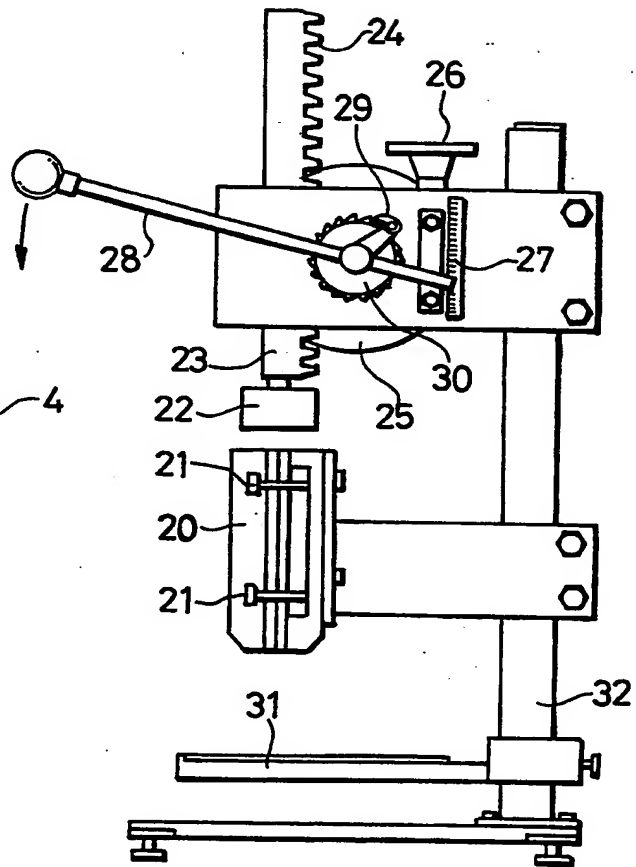


FIG. 6

